THE IMPACT OF INVESTMENT STRATEGY ON THE MARKET VALUE AND PRICING DECISIONS OF A PROPERTY/CASUALTY INSURER

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Abstract

This paper examines the impact of investment strategy on the market value and pricing decisions of a property/casualty insurance company. Section 2 utilizes classic financial theory to demonstrate the irrelevance of investment policy in perfect capital and product markets. Sections 3 through 6 illustrate four possible sources of investment policy relevance: imperfect information in property/casualty (P/C) insurance product markets, guaranty funds, conflicts of interest between shareholders and current policyholders, and taxes.

Lastly, Section 7 will discuss the implications of the optimal investment strategy on an insurer's pricing decisions. This section will close with a discussion of three commonly posed questions: (1) Is insurance a negative-net present value (NPV) transaction to the policyholder? (2) Does excess capital depress insurance prices? and (3) Does diversification create value?

1. INTRODUCTION

In 1995 and 1996, the bullish stock market produced large investment earnings for the property/casualty insurance industry. In fact, the increase in the industry's net income in 1996 was driven largely by continued growth in realized capital gains [12]. Not all insurers, however, benefited equally from the booming equity market. P/C insurance companies vary considerably in the proportion and composition of funds invested in the equity market.

Historically, long-term investment returns on common stocks have outperformed returns on bond portfolios [11, page 33]. Likewise, riskier common stock portfolios have generally produced better returns over the long run. In general, investors require some payoff for accepting greater investment risks, and this payoff comes in the form of higher expected returns. Given this relationship, many insurance managers may adopt a riskier investment strategy in order to increase earnings, return on equity (ROE), and shareholder value.

However, will adopting a riskier investment strategy, such as a higher proportion of equity investments, really increase shareholders' wealth?[1] In other words, can insurance management change the *total* value of the company by changing its asset allocation?

Section 2 of this paper utilizes classic financial theory to demonstrate the irrelevance of investment policy in perfect capital and product markets. In perfect markets, the only decision capable of creating or destroying value is the firm's underwriting decisions. Asset allocation does not matter.

In reality, however, insurers do not operate in perfect markets, and the insurer's investment choices can affect value. Sections 3 through 6 illustrate four possible sources of investment policy relevance: imperfect information in P/C insurance product markets, guaranty funds, conflicts of interest between shareholders and current policyholders, and taxes.

Given these relevant market imperfections, a value-maximizing asset allocation is possible. But what impact does this optimal investment portfolio have on competitive insurance prices? And how should this impact be reflected in insurance pricing models? Section 7 will discuss the implications of the optimal investment strategy on an insurer's pricing decisions.

[1]Shareholders' wealth is a measure of the total market value of the shareholders' investment in the firm.

Lastly, Section 7 will close with a discussion of three commonly posed questions: (1) Is insurance a negative-NPV transaction to the policyholder? (2) Does excess capital depress insurance prices? and (3) Does diversification create value?

2. INVESTMENT POLICY IRRELEVANCE IN PERFECT MARKETS

Nonfinancial Firms vs. Insurance Companies

Most of modern financial management theory focuses on decisions by nonfinancial firms, such as manufacturing and retailing concerns. Nonfinancial firms differ significantly from insurance firms in their investments, operations, and financing.

Nonfinancial firms make investments in product markets, the markets that bring together the buyers and sellers of goods and services. The structure of the various product markets ranges from pure monopoly to perfect competition. Those companies that acquire assets and capabilities in attractive product markets will earn superior profits [4]. Conversely, nonfinancial firms obtain financing in the capital markets, where competition is intense and profits are difficult to achieve.

Insurance companies operate in the reverse manner. Insurers make investments in the intensely competitive capital markets, where economic profits are elusive. On the right-hand side of the balance sheet, they obtain financing partially from insurance product markets. These markets may not be perfectly competitive in all niches at all times, allowing the possibility for superior profits.

A classic problem in finance considers the optimal capital structure, or financing decisions, for a nonfinancial firm. Given highly efficient capital markets, can the nonfinancial firm's financing decisions create value? In order to isolate the effect of the firm's financing decisions on value, its current assets and operations are usually considered fixed.

Given the inherent differences in their operating environment, it is logical to modify this problem for insurance companies. As mentioned, insurance companies deal with capital markets on the asset side. For insurers, we must consider the optimal investment strategy, given fixed financing from policyholders and shareholders.

Modigliani and Miller's Propositions I and II

In their famous Proposition I, Modigliani and Miller (abbreviated as "MM" throughout this paper) proved that the value of the nonfinancial firm is determined entirely on the left side of the balance sheet by the assets it owns [16]. The firm's capital structure, the mix of different securities it has issued, does not impact firm value. MM's proof assumes (1) perfect capital markets, including no taxes, and (2) the firm's financing decisions have no impact on the firm's investment decisions.

The implications of Proposition I are shown graphically in Figure 1. In perfect capital markets, the firm's debt ratio has no impact on its operating income (since investment strategy is fixed) or on the total firm value. As such, the expected rate of return on the firm's assets (r_A) is independent of the firm's debt ratio and is displayed as a horizontal line.

For low debt levels, the expected return on the debt (r_D) equals the risk-free rate of interest. As the firm borrows past a certain point, the firm's debtholders demand a higher interest rate; and the r_D curve slopes upward.

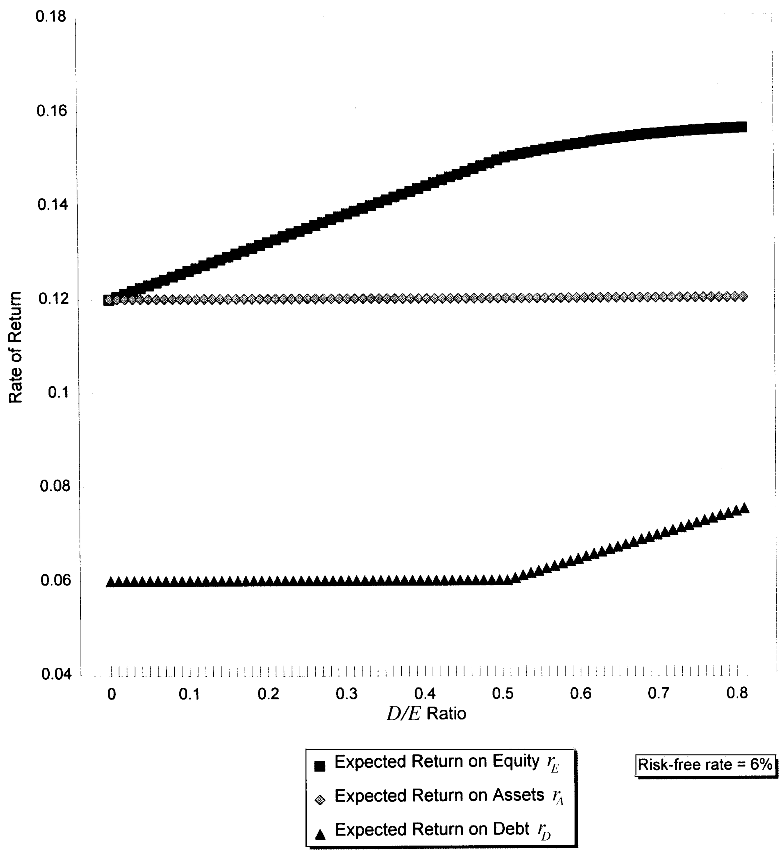
The expected return on the levered equity (r_E) is shown as the top curve on the graph. For low debt levels, r_E increases linearly with the debt ratio. Eventually, the slope of r_E decreases, as debtholders bear more of the business risk of the firm. The exact formula for the r_E curve is given by MM's Proposition II:

$$r_E = r_A + (D/E) \times (r_A - r_D).$$

Here, D/E represents the debt-to-equity ratio, expressed in market values.

FIGURE 1

MODIGLIANI AND MILLER'S PROPOSITION I



The Insurer as a Levered Equity Trust

In a 1968 *Proceedings* paper, J. Robert Ferrari proposed viewing the P/C insurer as a levered equity trust [9]. In other words, Ferrari visualized the insurer as borrowing funds from policyholders, then investing the combined policyholder and shareholder funds in financial assets.

The interest rate on the funds borrowed from policyholders is reflected in the premium charged. In the absence of taxes, the premium equals the present value of the expected losses and expenses under the policy.[2] In this sense, the "debt" issued by insurers is comparable to zero-coupon debt issued by corporations. That is, the return to the insurance "debtholders" is not provided by a regular interest payment, but by discounting the expected loss payment.[3]

Assuming a tax-free, perfectly competitive economy, the expected rate of return on the insurer's levered equity is given by the MM Proposition II formula. In this context, r_A represents the expected return on the insurer's asset portfolio, r_D represents the expected return on the insurer's liabilities, and the "D" term represents the present value of the insurer's liabilities.

Figure 2 displays the Proposition II formula graphically for a hypothetical insurance company. The company depicted in this figure holds a very conservative investment portfolio, as evidenced by the close proximity of the expected investment return (r_A) to the risk-free rate. Furthermore, the company's liabilities are risk-free at the current debt ratio. In other words, r_D is equal to the risk-free rate.[4]

Now assume that the company in Figure 2 decides to implement a more aggressive investment stance, perhaps investing a larger proportion of the portfolio in blue-chip stocks.

Figure 3 displays the consequences of this new investment policy. As shown, the riskier investment strategy results in an increased expected investment return (r_A). As r_A increases, the expected return to shareholders (r_E) increases according to the Proposition II formula.

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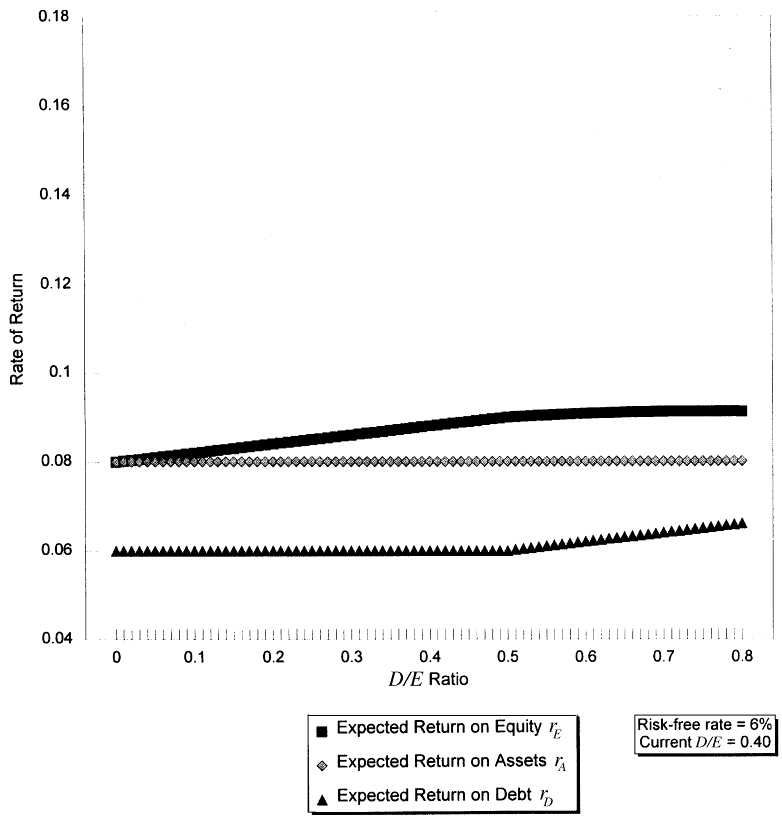
[2] This fact is demonstrated in the Myers and Cohn [18] article discussed in Section 7.

[3] See page 685 of [2] for a comparison of interest-paying bonds and pure-discount bonds.

[4] The covariance of insurance losses with the capital market return is often very low. In terms of the capital asset pricing model (CAPM), the beta of insurance losses is often close to zero, implying an expected return equal to the risk-free rate. However, this is not a necessary assumption for the proof.

FIGURE 2

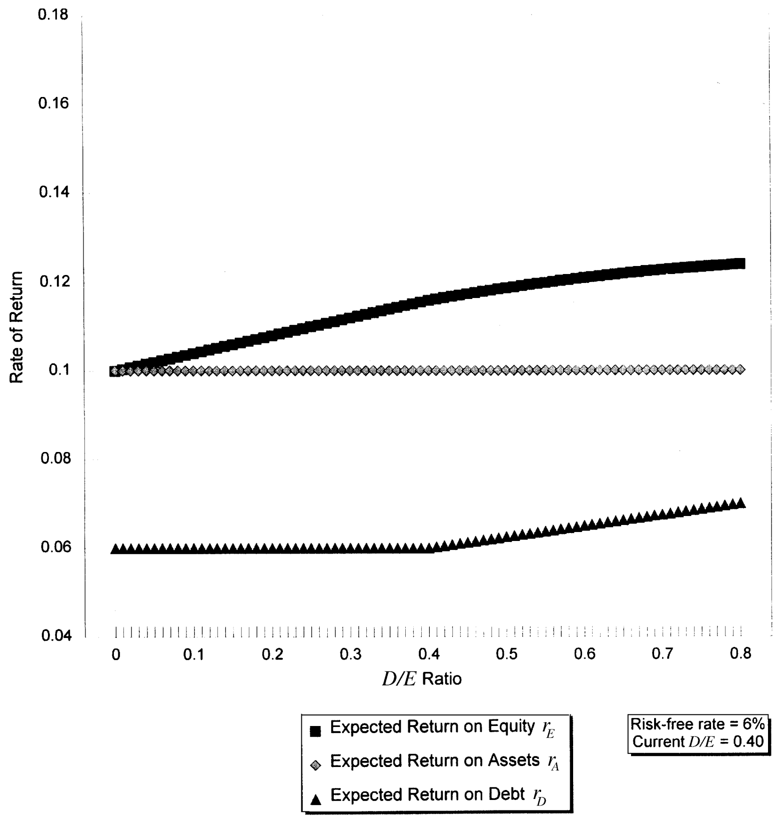
MODIGLIANI AND MILLER'S PROPOSITION II
(Conservative Investment Portfolio)



Does this higher expected return make shareholders better off? Unfortunately, the MM theory implies that the higher *expected* return will be exactly offset by a higher *required* return by shareholders. Specifically, the beta of the levered equity is expressed by an equation very similar in form to Proposition II: $B_E = B_A + (D/E) \times (B_A - B_D)$. Therefore, the systematic risk and required

FIGURE 3

MODIGLIANI AND MILLER'S PROPOSITION II
(Riskier Investment Strategy)

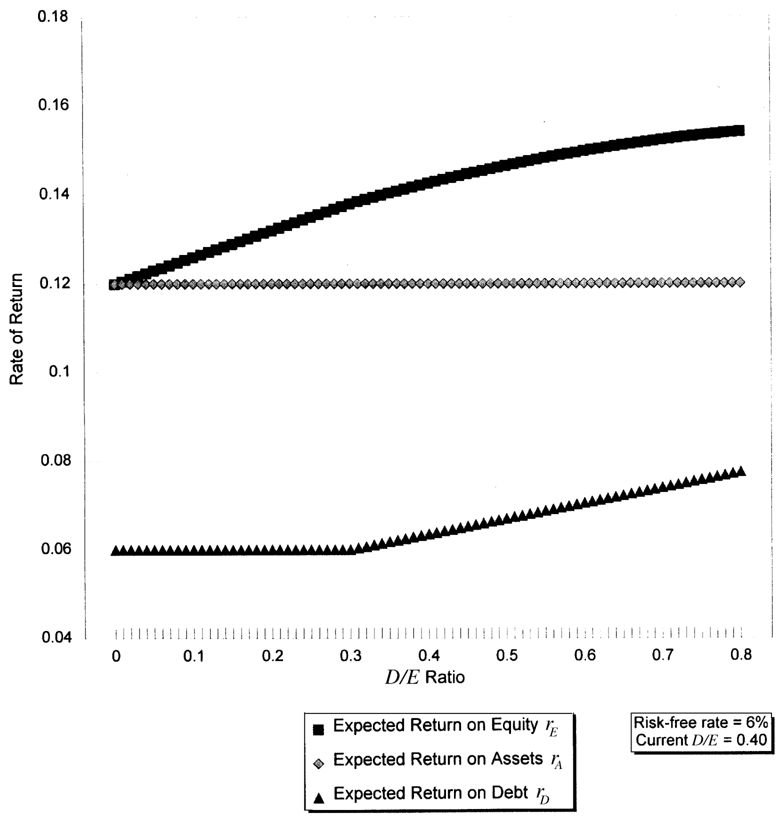


return on the levered equity increase exactly in lockstep with the expected return, leaving shareholder wealth unchanged [2, p. 456].

While the riskier investment policy displayed in Figure 3 increased r_A and r_E, the insurer's liabilities remained risk-free at the current debt ratio. Assume that our hypothetical insurer now

FIGURE 4

MODIGLIANI AND MILLER'S PROPOSITION II
(Riskiest Investment Portfolio)



decides to go for broke, investing entirely in risky stocks, collateralized mortgage obligations (CMOs), and derivatives.[5] Figure 4 shows the results of this new investment policy. Not surprisingly, the r_A line and the r_E curve each notch further up.

[5]In the U.S., investment regulations would most likely preclude such a risky asset allocation.

But from the policyholders' standpoint, the new investment policy results in a much greater risk that the insurer will default on its promises. Accordingly, the policyholders will mark down the value of the insurer's promise and demand a lower premium. Equivalently, the insurer will now have to assume more expected losses and expenses to maintain the same level of premium—and the same ongoing "debt" ratio. That is, the insurer is now paying a higher interest rate on the funds borrowed from policyholders. This is reflected in Figure 4, as r_D now exceeds the risk-free rate.

The systematic risk of the levered equity in Figure 4 is again given by the formula: $B_E = B_A + (D/E) \times (B_A - B_D)$. The B_D term adjusts to reflect the additional risk assumed by policyholders. Once again, required return increases in accordance with expected return, leaving shareholders' wealth unchanged. The critical assumption is that policyholders correctly identify and adjust for the investment change.

Thus, assuming perfectly competitive capital markets and insurance product markets, an insurance company's investment policy has no impact on the value of the company and the wealth of its shareholders. In reality, perfect MM conditions rarely exist, and investment policy can affect value. This paper explores the implications of several possible market imperfections on investment strategy, beginning with imperfect information in insurance markets.

3. IMPERFECT INFORMATION IN INSURANCE PRODUCT MARKETS

Section 2 demonstrated that a riskier investment strategy will increase the expected and required rate of return on levered equity. Moreover, a dramatic investment change may also increase the default risk and systematic risk of the insurer's liabilities, thereby eliciting an increase[6] in the insurer's r_D; new policyholders will then demand lower premiums.

[6]Any investment strategy that increases r_A will also increase r_E (Figure 3). However, we did not discuss the *degree* of investment risk required to induce an increase in r_D

The Section 2 proof assumes perfect competition as an insurance product market model. In a perfectly competitive market, every buyer possesses perfect information regarding the price and quality of the insurance promise. If the riskier investment policy forces an increase in r_D, new policyholders will recognize this.

In real world insurance markets, buyers rarely have perfect information. For instance, how many drivers are aware of the investment policies of competing personal auto carriers? And could a P/C insurer modify its investment strategy enough to increase the risk of its liabilities without policyholders noticing?

Fortunately, most market participants would agree that P/C insurance in the U.S. is a tremendously competitive business. Several thousand U.S. and foreign insurance companies compete for the business of millions of domestic customers. Consumer groups, state insurance departments, rating agencies, agents and brokers all work to ensure that sufficient information is promulgated to insurance buyers. These market conditions ensure that any investment change dramatic enough to impact the risk of the insurer's liabilities would be fully appreciated by buyers.

4. GUARANTY FUNDS

In a competitive insurance market, policyholders will recognize an investment shift that increases the risk of the insurer's liabilities. By shifting to a very risky investment policy, the insurance company will force the policyholders to share in the investment risk. While the policyholders are now sharing in these risks, they are also getting paid for it, by paying a lower insurance premium for the same policy. As long as these premium changes are conducted on *fair* terms, shareholders' wealth will not increase.

(Figure 4). For an insurer with a strong surplus position and a reasonably diversified underwriting portfolio, it may take a hair-curling investment change to increase r_D.

Under the U.S. guaranty fund system, however, policyholders will not bear all of the risks and costs of insolvency. A large part of these risks and costs will be absorbed by the guaranty fund.[7] In this case, *shareholders* will gain[8] from an investment change that increases r_D.

For example, assume that policyholders of insolvent insurance companies will be reimbursed on a full and timely basis by the guaranty fund. The riskiness of an insurance company's investment strategy is then irrelevant to the policyholder. Policyholders will discount expected losses and expenses at the risk-free rate regardless of the company's investment risk.

Thus, if an investment change increases r_D, the value of the shareholders' stake in the firm is increased. In effect, the guaranty fund's promise allows the company to obtain a subsidized loan from new policyholders. The value of the company is increased by the NPV of this loan. Provided that all parties are aware of the loan guarantee prior to the transaction, the entire increase in value will fall to the shareholders. The riskier the investment policy, the more valuable this loan guarantee becomes.

5. CONFLICTS OF INTEREST BETWEEN SHAREHOLDERS AND CURRENT POLICYHOLDERS

An investment policy which increases the insurer's r_D also creates a transfer of value from *current* policyholders to shareholders—even without the assumption of imperfect information or guaranty funds.

How does this transfer of value work? At the time the current policyholders purchased their policies, they discounted the insurer's promises at the lower risk-free rate. But after the invest-

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[7]Guaranty funds do not protect all policyholders. For instance, guaranty fund protection does not apply to policyholders of non-admitted insurance companies. Guaranty funds also do not provide "full" coverage in terms of amounts or certain lines of business.

[8]Remember: While every riskier investment strategy will increase r_A (see Figure 3), not every investment change will increase r_D (see Figure 4).

ment change, r_D exceeds this risk-free rate. If these policyholders were free to renegotiate the outstanding portion of their policies, the premium they would be willing to pay would be lower.[9] Yet, these contracts are not typically renegotiable—many, in fact, have already expired.

The total value of the insurance company's assets, however, is not changed by the switch into riskier investments. Assuming efficient capital markets, all financial assets are bought and sold at their fair value. With the value of the assets unchanged, the current policyholders' loss is the shareholders' gain.

Clearly, only a company that is already in financial trouble would adopt a riskier investment strategy for the purpose of creating a transfer of value from current policyholders to shareholders. However, the example serves to illustrate the general rule that a shift in the risk of the firm's assets benefits shareholders at the expense of debtholders.[10]

In sum, the imperfect information, guaranty funds, and transfer of value effects all encourage the insurer to invest in riskier securities.[11] Section 6 discusses the possibility that taxes may have an opposite effect, encouraging the insurer to invest significant amounts in bonds.

6. TAXES AND INVESTMENT POLICY

The proof of investment policy irrelevance in Section 2 relies on the assumption of a perfectly competitive, *tax-free* economy.

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[9] Assuming no guaranty fund applies.

[10] See Brealey and Myers [2, p. 492] for a general discussion, and Galai and Masulis [10, pp. 62–64] for a rigorous proof.

[11] In practice, increasing the riskiness of an insurance company's assets may actually have the perverse effect of decreasing shareholder wealth for two other reasons: (1) insurance buyers generally prefer not to share in the investment risk of the company, and (2) since insurance companies are subject to regulatory solvency constraints, increasing the volatility of its investments will increase the likelihood of losing an important intangible asset—franchise value. For insurers with valuable growth opportunities, the reduction in franchise value may dominate the guaranty fund and transfer of value effects. See [14, pp. 450–457 and 644].

The impact of taxes on the optimum capital structure and value of the corporation has been a source of debate in financial theory. Three competing theories have emerged: MM's original theory corrected for taxes, Miller's equilibrium theory, and a compromise theory. This section will briefly describe the three competing theories and discuss the implications of each theory on an insurer's choice between taxable bonds and common equity. The section will conclude with a brief discussion of municipal securities and dividend-paying stocks.

MM—The "Corrected" Theory

The original MM theory described in Section 2 concludes that a company's decision to borrow or lend money does not impact its market value. In 1963, MM modified the original theory to accommodate corporate taxes [17]. This modified theory stresses the corporate tax advantage of borrowing: debt interest is deductible at the corporate level, whereas dividends and retained earnings are not.

The "corrected" MM theory does not explicitly address investor taxes; only corporate taxes are relevant. This simplification implies that investor taxes are independent of the firm's debt policy; in other words, the effective *personal* tax rate on corporate debt equals the effective personal tax rate on corporate equity.

Under MM's revised theory, there is a clear tax disadvantage to corporate lending. A firm's decision to invest in taxable bonds decreases the value of the firm; this decrease in value is equal to the present value of *corporate* taxes paid on the investment.

For instance, suppose a hypothetical firm decides to issue \$1,000 of new equity and invest the money in a perpetual, risk-free, taxable bond with a 10% coupon. Assume the corporate tax rate is 35%. The firm's value is then reduced by the present value of a perpetual tax payment of $0.10 \times \$1,000 \times .35 = \$35$. The correct discount rate for these tax payments is generally assumed to be the interest rate on the bond; thus, the value of the company is reduced by $\$35/0.10 = \$350$.

However, suppose the same hypothetical firm were to invest the newly raised capital in risk-free (zero beta) common equity.[12] Given that the effective *personal* tax rates on equity income and bond income are equivalent, the expected return on the common stock equals the risk-free rate of interest. Yet, the firm is taxed at a lower rate on the common stock at the corporate level. This lower tax rate results from two provisions of the tax code: (1) corporations are only taxed on 30% of the dividends received from other corporations, and (2) equity income in the form of unrealized capital gains escapes taxation entirely. The result is a higher after-tax return to the firm on the common stock than the taxable bond.

Of course, to the extent that taxable interest income is offset by underwriting losses, investing in corporate bonds creates no tax disadvantage to the insurer. Yet, since the insurer cannot be certain of the actual underwriting losses, the safest strategy in this simplified MM world would be to invest solely in common stocks. Common stocks will offer the firm a higher after-tax return than taxable bonds of equivalent risk.

Varying Personal Tax Rates—Miller's Debt and Taxes

MM's corrected theory implies that an insurer's optimal investment strategy is to invest solely in common stock. Of course, we don't see any insurance companies doing this in practice.

The MM theory also leads to unrealistic implications for the optimal behavior of nonfinancial firms. At its extreme, the MM theory implies that industrial firms should employ entirely debt-financed capital structures. This extreme prediction, however, ignores an important cost of higher debt levels—the increased cost of bankruptcy and financial distress.

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[12]Zero beta common stock is not "risk-free" in the same sense as government debt; in this context, risk-free merely implies that the stock possesses no systematic, or undiversifiable, risk.

Specifically, MM's corrected theory asserts that a borrowing firm creates value through the corporate tax shield of debt. In practice, the value of this corporate tax shield will be partially offset by the expected cost of bankruptcy and financial distress.

Yet, many financial economists still worried about the implications of the theory. Compared to the enormous value of corporate tax shields, the expected costs of financial distress were generally low—implying that most firms should operate at extremely high debt levels. Merton Miller compared the situation to making horse-and-rabbit stew: mix in one horse and one rabbit, and it tastes an awful lot like horse stew.

Miller resolved the horse-and-rabbit stew dilemma by specifically introducing *investor* taxes into the mix [15]. Miller's revised theory assumed that the effective tax rate on equity is zero (due to the deferring of capital gains), but that individual tax rates on interest income varied from zero (for example, investments in pension funds) to rates that exceeded the corporate tax rate (for high-income individuals).

In Miller's world, the total amount of corporate debt would adjust to minimize the sum of corporate and personal taxes. All investors in tax brackets less than or equal to the corporate tax rate would hold corporate debt. Investors in higher tax brackets would hold equity or municipal (tax-free) bonds. The expected rate of return on risk-free common stocks would equal $r_f \times (1 - T_c)$, the risk-free interest rate times the complement of the *corporate* tax rate.

Under Miller's theory, there is no tax disadvantage to a firm investing in taxable bonds. For example, consider the hypothetical firm discussed in the previous subsection. The bond purchased earns interest of 10% before corporate taxes, but 6.5% after corporate taxes. The required return to the firm's *shareholders* on a risk-free investment is also 6.5% (10% × (1 – 0.35)). Thus, the investment has an NPV of zero and firm value is unchanged.

Miller's theory implies that an insurance company should invest solely in taxable bonds. Specifically, risk-free taxable bonds will offer investors a (pre-tax) return of r_f; risk-free common stock will offer a (pre-tax) return of $r_f \times (1 - T_c)$. Hence, tax-free investors gain value by investing in corporate bonds, which offer a higher return than common stocks of equivalent risk. To the extent that interest income is shielded by underwriting losses, the company is a tax-free investor. To the extent that interest is not shielded by underwriting losses, the company earns the same *after-tax* return on bond income as it would on risk-free equity income ($r_f \times (1 - T_c)$).

Miller coined the term "bondholders' surplus" to describe the extra (pre-tax) return on taxable bonds. According to the Miller model, this extra return is largest in the case of risk-free bonds [15, p. 271]. Therefore, the theory implies that insurers should invest in super-safe government debt to maximize bondholders' surplus. This results in a fortunate counterweight to the Sections 4 and 5 argument, which implied that insurers should invest in risky assets at the expense of the guaranty fund and current policyholders.

A Compromise Theory

DeAngelo and Masulis [6] and others have described a compromise theory that avoids the extreme assumptions and implications of the MM and Miller theories. The adherents of this view contend that Miller's assumptions are somewhat extreme and were not intended to be a realistic description of the tax code. Instead, most economists would agree that there is a moderate tax advantage to corporate borrowing (and corresponding tax *disadvantage* to corporate lending). However, this tax effect is less than the MM corrected theory predicts [2, p. 484].

Specifically, under this compromise theory, the tax code's effect on common stock returns is described by the factor T^*, which is between zero (MM) and the full corporate tax rate (Miller).

That is, the expected return on risk-free common stock is given by $r_f \times (1 - T^*)$.

To the extent that bond interest is shielded by underwriting losses, the company is a tax-free investor and benefits by investing in taxable bonds.[13] To the extent that interest income is not shielded by underwriting losses, the company generally earns a higher after-tax return on equity income than on bond income. For instance, if we assume that equity income escapes taxation at the corporate level,[14] the expected after-tax return on risk-free common stock is given by $r_f \times (1 - T^*)$; the expected after-tax return on risk-free bonds is $r_f \times (1 - T_c)$, where T_c is greater than T^*. Thus, the company should attempt to invest in taxable bonds up to the point where bond interest equals expected underwriting losses, with the balance invested in common stocks.

Fortunately, this optimal investment strategy under the compromise theory also works well in both the MM and Miller worlds. It satisfies Miller's mandate that the portion of investment returns shielded by underwriting losses should be derived from taxable bonds. It also satisfies the MM belief that common stocks offer a higher after-tax return than bonds for corporate investors in a tax-paying position.

While the theory to this point indicates that insurers should invest significant amounts in common stocks, it does not suggest which stocks are most appealing to insurers. For example, should insurers invest in high-dividend stocks to capitalize on the corporate dividend exclusion? Or should they invest in low-dividend stocks and benefit from the tax exclusion on unrealized capital gains?

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[13]Under the compromise theory, risk-free taxable bonds will offer the company a (pre-tax) return of r_f; risk-free common stock will offer a (pre-tax) return of $r_f \times (1 - T^*)$.

[14] In Section 7, Table 1 will demonstrate how an insurer can structure its asset portfolio so that equity returns escape taxation at the corporate level.

Common Stocks and Dividend Policy

Under the current (1996) tax law, many individual investors pay higher tax rates on dividends than capital gains. Today's tax code prescribes a maximum marginal tax rate of 39.6% on dividends and 28% on realized capital gains.[15] Furthermore, since capital gains taxes are deferred until the stock is sold, the effective tax rate on capital gains could be much less than 28%.

Many economists contend that the higher effective tax rate on dividends implies that high-dividend stocks must be priced to offer a higher pre-tax rate of return than low-dividend stocks of equivalent risk.[16] This differential compensates for the tax disadvantage of dividends and provides that both types of stocks offer identical after-tax returns.

In this case, the implication to corporate stock purchasers is clear. The higher pre-tax return on high-dividend stocks allows the benefits of the corporate dividend exclusion to overwhelm the tax deferral on capital gains. Insurers should respond by selecting stocks with high-dividend payouts—for example, utilities, real estate investment trusts (REITs), and oil companies.

Another group of economists, led by the late Fischer Black [1], offers a different view. This group agrees that a large class of high-income investors would prefer to invest in companies with low-dividend payouts. Other investors, such as corporate investors with short investment horizons, would pay lower taxes on dividends than capital gains and would prefer high-dividend stocks. And tax-free investors would remain neutral, paying no taxes on either dividends or capital gains.

The proponents of the alternative theory argue that a wide enough variety of stocks already exists to satisfy investors of

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[15] At the time of writing, the Taxpayers Relief Act of 1997 had not yet been finalized. The Act promises to lower the capital gains tax rate for certain long-term investments.

[16] See [2, pp. 430–431], for a detailed explanation. Also, Table 16-2, on p. 433, summarizes the research findings on the effect of dividend yield on returns.

any tax position. No company can increase (or decrease) its share price by modifying its dividend strategy; consequently, high-dividend stocks offer the same expected pre-tax return as low-dividend stocks of equivalent risk.

This alternative theory provides a simple prescription for all common stock investors, whether businesses or individuals: *given the equality of pre-tax returns on all stocks of the same risk, the equity investor should pick those stocks that minimize his or her taxes*.

For the corporate investor, the tax-minimizing stock selection depends on the investment time horizon. Suppose the corporation is merely looking for a short-term parking spot for some extra cash that will be needed in one year. The effective tax rate on dividends will be 10.5% (assuming 30% of dividends are taxed at 35%), while the effective tax rate on capital gains is 35%. This corporation should choose a high-dividend stock.

But the longer the corporation's investment time horizon, the lower the effective tax rate on capital gains becomes. For long-term corporate investors, low-dividend stocks become the investment vehicle of choice.

This suggests an optimal common stock strategy for the P/C insurer. The common stock portion of the investment portfolio is intended as a relatively permanent capital base for supporting current and future underwriting. In this sense, the insurer should select zero-dividend growth stocks, selling only as required to pay larger-than-expected insurance losses. If the insurer is forced to realize capital gains to pay insurance losses, these realized gains will be offset by underwriting losses, and still escape taxation.

Of course, an insurer that followed this strategy precisely would have no extra cash to pay out as shareholder dividends. Would this zero-payout strategy affect the value of the insurer's shares? Provided that the "dividends-are-irrelevant" school is right, the market value and pre-tax return of the insurance company would not be impacted by its dividend policy.

A Comment on Municipal (Tax-Exempt) Bonds and Preferred Stock

The discussion above concentrates on the broad asset classes of taxable bonds and common equity. Historically, insurers have also purchased large amounts of preferred stock and tax-exempt bonds. The standard investment approach has emphasized tax-exempt bonds and the dividends-received deduction to minimize federal income taxes and maximize net income [13, pages 4: 66–67].

Prior to the Tax Reform Act (TRA) of 1986, tax-exempt bonds and preferred dividends offered special tax advantages to insurers. The TRA of 1986 eliminated most of these tax advantages, rendering these investments inferior to other alternatives. For example, tax-exempt bonds should offer similar pre-tax returns as growth stocks of identical risk.[17] But the insurer will now be taxed on the tax-exempt bond income according to the proration and Alternative Minimum Tax (AMT) provisions of the tax code, while unrealized capital gains on the growth stocks remain tax-exempt.

Likewise, many insurance company portfolio managers in the past espoused the view that high-dividend stocks offered higher pre-tax yields. The TRA of 1986 equalized personal tax rates on dividends and realized capital gains, converting many investment managers to the Fischer Black school. The new mantra became minimizing taxes on stock purchases, and preferred stocks lost much of their original appeal.

[17]For the individual investor, municipal bonds are taxed at a lower rate than equity returns: municipal bond interest is tax-free, while investors still pay taxes on dividends and realized gains from stocks. Moreover, the vast majority of municipal bonds are held by individuals [3, p. 43]. Due to the personal tax advantages of municipals, these securities should actually offer a slightly *lower* pre-tax yield than common stock of equivalent risk. For a detailed proof, see [6, p. 26].

7. INTERACTION OF INVESTMENT POLICY AND INSURANCE PRICING

The Traditional DCF Pricing Model Under MM Assumptions

Myers and Cohn [18] describe a Discounted Cash Flow (DCF) insurance pricing model that is widely used for internal profitability studies and regulatory purposes. The model derives the fair insurance premium, which provides shareholders with an adequate expected rate of return. This fair premium is partly a function of the present value of expected losses and expenses resulting from the policy.

In theory, the discount rate used to capitalize expected losses and expenses should vary by line of business. Certain lines of business, such as credit or unemployment insurance, possess a high degree of systematic risk and deserve a correspondingly high discount rate. Most of the risk of other lines, such as crop/hail or earthquake, is diversifiable—the risk-free rate may be appropriate for these coverages.

Moreover, the theory presented in this paper demonstrates that the correct discount rate for insurance liabilities also depends on the insurer's asset allocation. Insurers with very risky investment strategies merit higher hurdle rates.

The DCF model also includes two adjustments to the fair premium. First, the present value of taxes on investment income from both policyholder-supplied and shareholder-supplied funds must be included in the fair premium. Second, the fair premium is reduced by the present value (PV) of the corporate tax shield from underwriting losses. This tax shield is calculated as 35% of expected underwriting losses.

In sum, the traditional DCF pricing formula calculates the fair premium as follows:

fair insurance premium

= PV of expected losses and expenses

+ PV of expected tax on investment income from policyholder and shareholder supplied funds

– PV of corporate tax shield from underwriting losses

Most DCF pricing models in practical use assume the MM (corrected) theory of debt and taxes. These models typically *assume* that (1) the MM model correctly describes the tax disadvantage of corporate lending, and (2) insurers invest solely in taxable bonds. As such, the common equity value of the insurer is reduced by the tax disadvantage of corporate investment.

But given the tax disadvantage of corporate lending in the MM world, why would the insurance company invest solely in taxable bonds? The discussion in Section 6 indicates that the safest strategy in this scenario would be to invest entirely in risk-free (zero beta) common stock, selling only enough shares at the end of the period to pay actual indemnity losses. The insurer will pay taxes in good years—for example when indemnity losses are less than expected (perhaps even leading to an underwriting profit), and investment returns are positive (shares sold to pay the indemnity losses are sold at a capital gain). In bad years, the insurer will earn tax carry-overs—for example, when indemnity losses are high (a large underwriting loss) and investment returns are negative (shares sold to pay indemnity losses generate a capital loss).

On average, expected underwriting losses will offset expected realized capital gains. Provided that all equity returns come as capital gains, and tax credits can be carried forward or back, the insurer's expected tax bill will be zero.

Thus, the present value of expected insurance company tax is zero. The DCF insurance premium is given by the present value of expected losses and expenses—there is no need to adjust the DCF premium for insurance company tax or tax shields.

The DCF Model Under Miller and Compromise Theories

Under the Miller theory of debt and taxes, the optimal investment strategy comprises 100% taxable bonds. Since Miller's model implies that there is no tax disadvantage to corporate lending, there is no need to include the present value of corporate taxes on investment income as part of the insurance premium. Likewise, corporate tax shields on debt create no value in Miller's world and the third term in the DCF equation drops off as well. The DCF pricing model then indicates that the market insurance premium equals the present value of expected losses and expenses.

Under the compromise theory, the optimal investment portfolio includes the proper proportion of both taxable bonds and growth stocks. As in the optimal MM strategy of all-equity investing, the insurer will pay taxes in some years and earn tax credits in other years. Provided the insurer has correctly estimated expected underwriting losses, the expected tax amount will be zero. As such, the market premium will also be given by the discounted value of expected losses and expenses.

An Illustrative Example

Table 1 provides an illustrative one-period example to demonstrate the impact of the optimal investment decision on the insurer's pricing decision. The model assumes that expected losses and expenses of \$500 will be paid at the end of the period. The appropriate discount rate for the expected losses equals the risk-free rate of 6%. Surplus of \$500 has been allocated to support the business. As noted in the previous two subsections, the fair premium is equal to the present value of expected losses and expenses, or \$500/1.06 = \$471.70.

The insurer will invest in some combination of risk-free common stock and taxable bonds. Since the insurer's assets and li-

TABLE 1

IMPACT OF INVESTMENT STRATEGY ON PRICING DECISIONS

		(1) MM	(2) Miller	(3) Compromise
a	Risk-free rate	6.0%	6.0%	6.0%
b	Expected losses and expenses at end of period	500	500	500
c	Surplus allocated to support policy	500	500	500
d	Premium collected at beginning of period = b/(1.0 + a)	471.70	471.70	471.70
e	Total assets at beginning of period = c + d	971.70	971.70	971.70
f	Taxable bonds at beginning of period	0.00	971.70	471.70
g	Expected return on taxable bonds	6.0%	6.0%	6.0%
h	Common stock at beginning of period = e − f	971.70	0.00	500.00
i	Expected return on common stock	6.0%	3.9%	4.5%
j	Common stock price per share at beginning of period	1.00	1.00	1.00
k	Common shares purchased = h/j	971.70	0.00	500.00
l	Expected share price at end of period = j × (1.0 + i)	1.06	1.04	1.05
m	Expected number of shares sold to pay losses	471.70	0.00	0.00
n	Expected number of shares not sold = k − m	500.00	0.00	500.00
o	Expected underwriting income = d − b	(28.30)	(28.30)	(28.30)
p	Expected taxable bond interest = f × g	0.00	58.30	28.30
q	Expected realized capital gains = m × i	28.30	0.00	0.00
r	Expected unrealized capital gains = n × i	30.00	0.00	22.50
s	Expected taxable income = o + p + q	0.00	30.00	0.00
t	Expected tax payment = 0.35 × s	0.00	10.50	0.00
u	Expected dollar return to shareholders = o + p + q + r − t	30.00	19.50	22.50
v	Expected percentage return to shareholders = u/c	6.0%	3.9%	4.5%
w	Required percentage return to shareholders	6.0%	3.9%	4.5%

abilities are *both* risk-free, the insurer's shareholders require a total return equal to the expected return that they could achieve from *other* risk-free common stocks. The marginal corporate tax rate is 35%.

Column 1 displays the expected tax and ROE in an MM world. As noted in Section 6, the insurer will invest entirely in risk-free growth stocks, selling only as necessary to pay losses and expenses. As shown in the table, expected realized capital gains are offset by expected underwriting losses and the $471.70 premium provides the insurer's shareholders with the required 6% return.

Next, recall that in the Miller world the expected return on risk-free common stock equals $r_f \times (1 - T_c)$. Therefore, the insurer's shareholders require an expected return of $6\% \times (1 - 0.35) = 3.9\%$. Also, recall that the optimum strategy holds only taxable bonds. As shown, this strategy provides shareholders with the required return of 3.9%.

Finally, we must specify T^* for the compromise world, which lies somewhere between 0% and 35%. Let's assume $T^* = 25\%$. Thus, risk-free common stock offers an expected return of $r_f \times (1 - 0.25) = 4.5\%$. As described in Section 6, the insurer's optimum strategy equates taxable bond interest and expected underwriting losses, with the balance invested in risk-free growth stocks. Again, this strategy will provide the required return to shareholders.

Is Insurance a Negative-NPV Transaction for the Insured?

In the popular version of the DCF model (that is, an MM world with all insurers investing 100% in taxable bonds) the PV of tax on investment income outweighs the PV of the corporate tax shield from underwriting losses. Therefore, the fair insurance premium exceeds the discounted value of expected indemnity losses and insurance expenses. From the policyholder's standpoint, the insurance purchase is a negative-NPV transaction.

But provided that the insurer follows an optimal investment strategy, the DCF model implies that the fair premium is given by the discounted value of expected losses and expenses under each of the three theories of debt and taxes.

Since each prospective policyholder pays a premium equal to the discounted value of expected losses and expenses, insurance is a zero-NPV transaction to the policyholder—assuming problems such as adverse selection and moral hazard are not significant, and that the insured could not handle the risks at a lower expense level than the insurance company.

Does Excess Capital Depress Insurance Prices?

In the traditional DCF model, the present value of taxes on the investment income from shareholder-supplied funds is included in the fair premium. The greater the marginal surplus required for a given insurer to write a policy, the higher this tax amount will be. This logic is the foundation of the popular idea that excess surplus contributes to lower pricing in our industry.

For example, assume two insurance companies are competing for the same account. Insurer A has excess capital and requires no additional marginal capital to write the account. Insurer B is already operating at a high premium-to-surplus ratio and requires $500 of additional capital. The traditional DCF model implies that the fair premium for insurer B is higher than the fair premium for Insurer A[18] by the discounted value of the investment income tax on the $500.

Yet, provided that Insurer B follows an optimal investment strategy, the additional capital required creates no tax disadvantage. Under all three theories of debt and taxes, the *expected* return on the additional capital equals the shareholders' *required* return.

[18]Assuming Insurer B has ready access to capital markets and ignoring issue costs.

For instance, assume that Insurer B decides to invest the marginal capital in risk-free securities. Table 2 summarizes the investment choice, expected return and required return under each of the theories:

TABLE 2

SUMMARY OF RETURNS

Theory	Investment Choice	Pre-tax Expected Return	After-tax Expected Return	Shareholders' Required Return
MM	Common stock	r_f	r_f	r_f
Miller	Taxable bonds	r_f	$r_f \times (1 - T_c)$	$r_f \times (1 - T_c)$
Compromise	Common stock	$r_f \times (1 - T^*)$	$r_f \times (1 - T^*)$	$r_f \times (1 - T^*)$

Does Diversification Create Value?

The traditional view in the insurance industry has held that a diversified underwriting portfolio reduces risk and creates value. As in the previous subsection, this view is based on the notion that there is a tax disadvantage associated with excess surplus. The greater the marginal surplus required to write a given policy, the higher the premium.

For instance, the loss experience for a given policy may be negatively correlated with the current loss exposures in an insurer's book. The marginal surplus required to support the policy may be very low, perhaps even negative. Under the traditional DCF assumptions, such a policy would be very attractive to the insurer: the insurer can offer a lower premium and still meet its financial goals.

According to this view, present values do not add up. The insurer must evaluate every policy as a potential addition to its current book of business. Underwriting decisions become extremely complex.

If we instead assume that every insurer follows an optimal investment strategy, then value additivity is restored. Insurance pricing is independent of marginal surplus, and every policy can be evaluated on its own merits. Diversification for its own sake does not increase value.

Optimal Asset Allocation—The Theory Versus Reality

Do insurers really follow an optimal investment strategy? If so, fair premium equals the discounted value of expected losses and expenses. Furthermore, the insurer's expected tax bill in both the MM and compromise worlds is zero, and the insurer pays no shareholder dividends.

However, insurance companies on average do pay taxes. Insurers also pay shareholder dividends. One possible explanation for this discrepancy may lie in investment laws and regulations imposed on the industry. For example, investment laws may preclude the insurer from holding stocks without established dividend records. Also certain laws and regulations may limit common stock holdings to a certain percentage of assets or surplus. This maximum amount may be below the theoretically optimal amount.

If these investment restrictions do indeed preclude insurers from holding optimal investment portfolios, competitive insurance premiums will adjust until insurance shareholders earn their required return. In this case, insurance premiums will exceed the discounted value of expected losses and expenses. Insurance would be a negative-NPV transaction to the insured, even in the absence of adverse selection and moral hazard problems. There would also be a moderate tax disadvantage to holding excess surplus, and insurers with excess surplus would price at a lower level.

Still, many insurers have the capacity to increase common stock holdings and enjoy increased tax advantages. Moreover, part of the industry's tax bill may result from excessive trading and unnecessary realized capital gains. Insurers are often motivated to realize capital gains unnecessarily in an effort to "dress up" the income statement. Statutory accounting rules allow realized capital gains to contribute to earnings, whereas unrealized capital gains are direct contributions to surplus. In an efficient market, investors see through transparent accounting conventions to real value. In this case, efforts to boost earnings through premature asset sales offer no benefit, while only resulting in higher taxes.

8. CONCLUSION

Actuaries are becoming more involved in the insurer's asset allocation decision. Recently, dynamic financial analysis (DFA) models have been utilized to maximize investment income and earnings subject to certain solvency constraints. But in an efficient market, the asset allocation decision is irrelevant. Indeed, any investment change that increases earnings will simultaneously increase the riskiness of those earnings, leaving share price unchanged.

When it comes to asset allocation decisions, a little financial theory may be much better than a thousand simulations. Specifically, one must specify the *source* of value from changing the asset mix. For instance, a riskier investment strategy may increase value by creating a loan subsidy from the guaranty fund.[19]

As noted earlier, only a financially troubled company would attempt to prop up share price at the expense of the guaranty fund or current policyholders. A better approach to the problem focuses on the impact of government taxation on the insurer's

[19]The guaranty fund mechanism, of course, was not intended to subsidize riskier investment strategies. To this end, regulators could take a page out of the Pension Benefit Guarantee Corporation's (PBGC) book, varying the guaranty fund assessment according to the riskiness of the insurer's asset portfolio.

optimum investment choice. This requires an understanding of the theories of debt and taxes, as well as the relationship between dividend yield and common stock returns. Section 6 of this paper analyzed these issues and recommended an optimum investment approach for each view of debt and taxes.

Moreover, under an optimum investment strategy, the fair premium for the property/liability policy will be given by the discounted value of expected losses and expenses—no adjustment will be required for the tax disadvantage of corporate investments.[20] This implies that the fair insurance premium is independent of the amount of surplus allocated to the policy.

Here we have an apparent contradiction with current actuarial practice. Actuaries expend a great deal of time and energy allocating surplus to line of business, profit center, etc., as part of the normal ratemaking process [5, pp. 541–547]. Furthermore, many pricing models take this exercise a step further and require the actuary to specify the release of this surplus over time [8, pp. 20–25]. Instead of directing so much energy to these endeavors, one may be better served to ask, "How can we modify our asset allocation to make surplus less tax-inefficient?"

Of course, more research still remains to determine the optimum asset portfolio for an insurer and the impacts of this portfolio on the actuary's financial pricing models. In closing, a quote from Myers and Cohn's classic DCF paper still remains relevant today [18, p. 65]:

> There is little in the insurance literature regarding the optimal asset portfolio, given taxes, for an insurance company. Are insurance companies' common-stock values reduced by the seeming tax disadvantage associated with corporate purchases of taxable marketable

[20] The traditional view has held that the fair insurance premium must include a provision for the tax disadvantage of corporate investments, even assuming the insurer has adopted an optimum asset allocation. See, for instance, Derrig's recent paper. [7]

securities? … The present-value approach as it is employed in this report … [is] probably not exactly correct in specifying fair insurance premiums, and it is not clear just how the approach should be modified so as to take corporate taxes properly into account.

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